CLAIM AMENDMENTS

The present listing of claims replaces all prior versions and listings of claims in the subject patent application.

Listing of Claims:

Claim 1 (currently amended): A method for generating ultrabright multikilovolt coherent tunable radiation in the x-ray region of the electromagnetic spectrum, comprising:

(a) generating pulsed laser radiation having a chosen power, pulsewidth and wavelength;

(b) generating atomic clusters having a chosen size and density;

(c) directing the laser radiation into the atomic clusters wherein rapid atomic excitation is generated having selected inner-shell electron atomic electrons being removed from the atoms without the removal of all of the electrons in the next outermost shell, thereby generating a population inversion from which a chosen wavelength of radiation is amplified or spontaneously generated in the x-ray region of the electromagnetic spectrum, and wherein the generated or amplified radiation is propagated in a self-trapped plasma channel region additionally having a nonlinear mode of confined propagation for the chosen wavelength of radiation; and

(d) simultaneously controlling the density of said atomic clusters, the density of plasma electrons, and the laser radiation such that the wavelength of amplification is defined.

Claim 2 (original): The method as described in claim 1, wherein the cluster size is chosen to minimize the laser intensity required to excite substantially all of the atoms in the cluster.

Claim 3 (original): The method as described in claim 1, wherein the pulsewidth is chosen such that atomic excitation occurs on a timescale which is short compared with recombination processes in the plasma produced.

Claim 4 (original): The method as described in claim 3, wherein the pulsewidth is less than 1 ps.

Claim 5 (original): The method as described in claim 1, wherein the power and wavelength of the laser radiation, and the atoms in the clusters are chosen such that the desired x-ray wavelength is generated.

Claim 6 (original): The method as described in claim 5, wherein the atoms in the atomic clusters are heavy atoms.

Claim 7 (original): The method as described in claim 6, wherein the atoms include Xe and the laser radiation includes 248 nm radiation.

Claim 8 (original): An apparatus for generating ultrabright multikilovolt coherent tunable radiation in the x-ray region of the electromagnetic spectrum, comprising in combination:

(a) a pulsed laser for generating radiation having a chosen power, pulsewidth and wavelength;

(b) means for generating atomic clusters having a chosen size and density; and

(c) means for directing the laser radiation into the atomic clusters wherein rapid atomic excitation is generated having selected inner-shell electron atomic electrons being removed from the atoms without the removal of all of the electrons in the next outermost shell, thereby generating a population inversion from which a chosen wavelength of x-radiation is amplified or spontaneously generated, and wherein the laser generated or amplified radiation is propagated in a self-trapped plasma channel region additionally having a nonlinear mode of confined propagation for the chosen wavelength of x-radiation; whereby if the density of said atomic clusters, the density of plasma electrons, and the laser radiation are simultaneously controlled, the spectrum of x-ray amplification is defined.

Claim 9 (original): The apparatus as described in claim 8, wherein the cluster size is chosen to minimize the laser intensity required to excite substantially all of the atoms in the cluster.

Claim 10 (original): The apparatus as described in claim 8, wherein the pulsewidth of the laser is chosen such that atomic excitation occurs on a timescale which is short compared with recombination processes in the plasma produced.

Claim 11 (original): The apparatus as described in claim 10, wherein the pulse width is less than 1 ps.

Claim 12 (original): The apparatus as described in claim 8, wherein the intensity and wavelength of the laser radiation, and the atoms in the clusters are chosen such that the desired x-ray wavelength is generated.

Claim 13 (original): The apparatus as described in claim 8, wherein the atoms in the clusters are heavy atoms.

Claim 14 (original): The apparatus as described in claim 13, wherein the atoms include Xe and the laser radiation includes 248 nm radiation.